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The new DEAL – a novel technique using a double-entry access loop to facilitate bilateral intrahepatic biliary access for complex intrahepatic stones

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The management of patients with primary intrahepatic stones may be complex as the natural history is frequently complicated by further episodes of cholangitis after initial treatment because of residual or recurrent intrahepatic stones or strictures.[1] Curative segmental or lobar hepatic resection of atrophic segments and diseased ducts is possible in only the 20% of patients with localised stones or strictures.[2] Complete stone removal by resection is therefore not feasible in the majority of patients with bilateral lobar stones and strictures. Patients who subsequently develop cholangitis pose a major operative risk if secondary biliary cirrhosis, portal hypertension or the atrophy-hypertrophy complex has occurred.[3] Treatment of recurrent stones and strictures via the percutaneous transhepatic biliary route is successful in only 70% of patients.[3] In order to avoid these hazards, to reduce the incidence of incomplete operative stone removal and to facilitate extraction of recurrent intrahepatic stones, we have used a multidisciplinary approach in complex hepatolithiasis, combining resection of atrophic liver segments with a modified hepaticojejunostomy incorporating permanent access for interventional radiological procedures via a jejunal access loop.[4]

A single percutaneous entry site may limit optimal access to all intrahepatic ducts in both right and left lobes, especially if the intrahepatic segmental duct orifices are angulated, stenotic or obstructed. An access loop may also be difficult to enter after repeated percutaneous punctures because of fibrosis or peri-jejunal adhesions at the site of attachment to the anterior or lateral abdominal wall, especially following repeated manipulation and low-grade sepsis. We describe a new double-entry access loop (DEAL) technique as a modification of the subparietal single-entry access loop to enhance percutaneous radiological entry and facilitate intrahepatic biliary intervention.

Method

Surgical technique

A bilateral subcostal incision is used to provide exposure to the porta hepatis. The common hepatic duct is opened at the confluence of the left and right ducts and stones are retrieved. Intraoperative choledochoscopy is performed to identify intrahepatic stones, which are removed using a combination of Desjardine's forceps, Fogarty biliary balloon catheters, dormia baskets, stone crushing under direct vision with a rigid Storz choledochoscope and biopsy forcep attachment, and vigorous upstream saline flushing with a paediatric feeding tube. Intraoperative cholangiography may be used to further define intraheptic strictures, which are dilated using an angioplasty balloon under fluoroscopic control in order to aid removal of all stones. When atrophy or multiple cholangitic abscesses are present, a left lateral segmentectomy or lobectomy is performed. A biliary-enteric anastomosis is constructed using a side-to-side anastomosis (Fig. 1) between

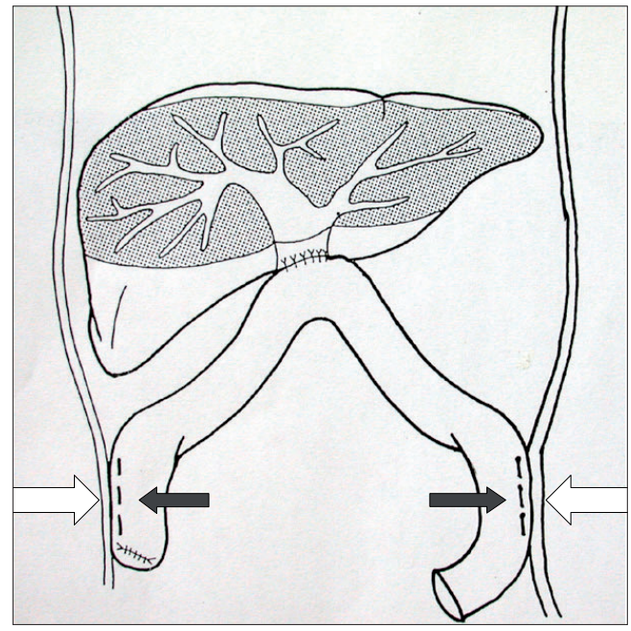

Fig. 1. Double-entry access loop attached to the right and left anterior abdominal wall (white arrows) and marked with metal clips at sites of entry (black arrows) to facilitate percutaneous radiological identification and puncture.

the hepatic duct confluence and a Roux-en-Y jejunal loop. If the left or right duct is narrowed, the hepatic duct incision is extended beyond the stricture to provide a wide anastomosis. A site 12 cm proximal to the closed end of the jejunal loop is selected for the anastomosis to the hepatic duct confluence, performed using a single layer of interrupted 4/0 Maxon sutures. Two ligaclips are used to mark the anastomosis for later radiological identification. The closed proximal limb is attached to the anterior abdominal wall using 3/0 polypropylene sutures to fix the end of the limb in a subparietal position. Six further ligaclips are used to mark the width and orientation of the jejunal loop by attaching the clips to the two parallel rows of sutures holding the access loop in place (Fig. 1). In order to fashion a second and contralateral percutaneous entry point, the efferent limb is secured to the opposite abdominal wall for a length of 4 cm, about 10 cm from the hepaticojejunostomy and similarly marked with six metal clips (Fig. 1).

Radiological technique

Local anaesthetic is injected at the selected puncture site after the afferent and efferent entry points are identified fluoroscopically, by determining the position of the ligaclip 'runway lights'. Either loop can then be entered percutaneously between the runway clips, using a 21-gauge fine-bore needle, with intermittent contrast injections and a guidewire (Figs 2 and 3). A converting dilator permits percutaneous introduction of larger guidewire/catheter combinations into the jejunal lumen and thereafter a combination of Dormia baskets, angioplasty balloons and snare wires directed by fluoroscopy are used to fragment and remove calculi. Biliary stenoses are dilated using standard 4 - 8 mm angioplasty balloons. On completion the ducts are flushed with saline.

Discussion

Bilateral primary intrahepatic calculi may be difficult to remove completely by surgical, endoscopic or percutaneous methods. Often multiple procedures are required to obtain complete clearance.[1-3] One method of allowing repeated percutaneous entry is the creation of a permanent and re-usable access site without the need for tubes or stomas.[4] Percutaneous transjejunal biliary intervention has now become an integral part of the multidisciplinary management of complex intrahepatic strictures and stones since the initial descriptions by Fang and Chou,[5] Barker and Winkler[6] and Hutson *et al.*[7] The access loop provides entry to the hepatic ducts and allows repeated radiological intervention, thus avoiding the disadvantages of the transhepatic route.[8] The cutaneous stoma originally described has been replaced by a more effective and convenient closed subparietal jejunal loop.[9]

The ability of the radiologist to locate and puncture the jejunal loop is partly dependent on the quality of the loop construction and its attachment to the anterior abdominal wall. Secure subparietal fixation and clear marking of the loop for fluoroscopic identification allow consistently successful percutaneous entry.[10] The jejunal access loop should be placed in an antecolic position and the limb between the hepaticojejunal anastomosis and the site of subparietal fixation should be short and straight.[10] The terminal 4 cm of the bowel sutured to the peritoneum of the abdominal wall is marked with two parallel rows of metal clips, providing

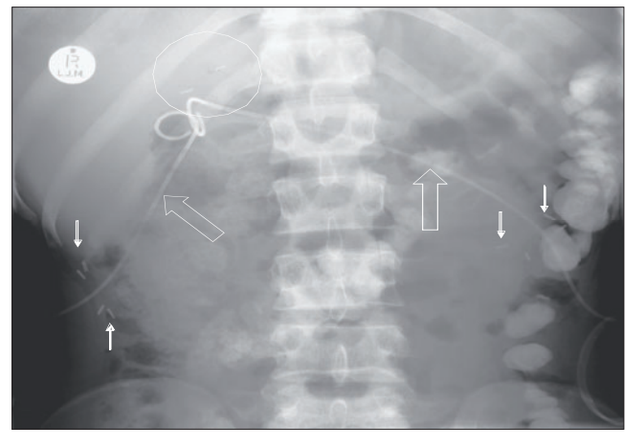

Fig. 2. Dual-access percutaneous catheters (open arrows) inserted via the right and left jejunal entry sites. Parallel clips mark the right and left entry sites (small arrows). The hepaticojejunal anastomosis in the porta hepatis is marked with two clips (circle).

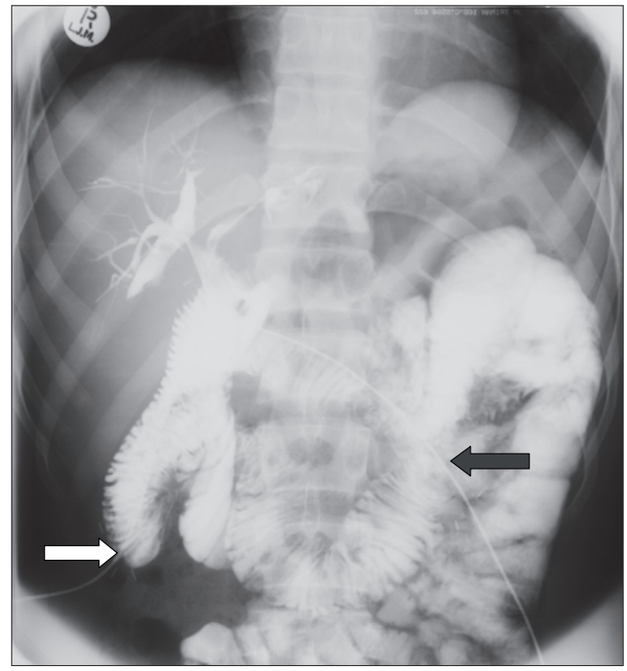

Fig. 3. Contrast injected to opacify the intrahepatic bile ducts via the dual-access percutaneous catheters inserted through the right attached jejunal loop entry site (white arrow) and left jejunal loop entry site (black arrow).

'runway lights' for radiological identification and puncture. The site of attachment of the loop is important and it is generally best fixed to the contralateral abdominal wall opposite the dominant pathology in the liver, to provide a more direct and linear approach. If entry into the loop is difficult, high-frequency ultrasound can facilitate identification of the surgical clips and placement of the needle tip into the access loop. Two additional radio-opaque clips on either side of the hepaticojejunostomy are useful in assisting the interventional radiologist to identify the site of the anastomosis at the porta hepatis.[10]

Difficulty may be experienced when attempting re-entry owing to stricturing of the blind end of the loop. Peri-jenunal haematoma and later fibrosis may lead to narrowing of the

loop, complicating entry even with the use of ultrasound to identify the lumen. Repeated contrast injections during attempted entry may obscure the area. The new DEAL technique has a number of practical advantages. These include the options of alternative access sites, with a choice of either left- or right-sided approaches, depending on which lobe or segment of the liver has the most stones. The dual access allows easier entry into the contralateral segments, with the direct axial orientation of the catheters facilitating guidewire, basket and balloon manipulations. The combined access also allows two interventional radiologists to work simultaneously by inserting additional supporting catheters to crush, flush, and extract stones.

Conclusion

The jejunal biliary access loop technique simplifies subsequent percutaneous interventions and avoids the need for multiple operative procedures in patients with recurrent intrahepatic strictures and stones. An access loop eliminates the need for prolonged external tubes and is suited to percutaneous radiological intrahepatic instrumentation. The DEAL technique of placing a second set of radio-opaque markers on the efferent limb of a hepaticojejunostomy to create an additional access site adds little to the procedure and contributes to the subsequent management of patients with intrahepatic stones who require repeated percutaneous intrahepatic duct access.

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